Computing Bottom-Up Betas For Companies In The Soft Drink Industry

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ABSTRACT

In this paper, we decompose the CAPM equity beta for Coca-Cola and Pepsi (KOPEP) to show the industry component and the operating leverage and the financial leverage components for the period from 2004 to 2012. We compute the CAPM equity betas using a standard five year, sixty month, regression between returns for KOPEP using the S&P500 as the market index. We adjust for financial leverage using the Hamada (1969) methodology and we adjust for operating leverage using the degree of operating leverage (DOL). The average business beta for Coca-Cola is 0.1882 and the average business beta for Pepsico is 0.1369. Over the period of this analysis, Coca-Cola has had a business beta slightly higher than the business beta for Pepsico.

Keywords: CAPM; Bottom-Up Beta; Equity Beta; Unlevered Beta; Business Beta; Coca-Cola; Pepsi

INTRODUCTION

The objective of corporate financial management is to maximize the value of the firm. The value of the firm is the market value of the firm determined by multiplying the number of shares outstanding times the price per share. The price of a share of stock in a corporation is the discounted present value of the future cash flows from the share including dividends and capital gains. Estimates of the future cash flows are based on the concept of free cash flow to equity such as developed in Damodaran (2006). Brigham and Ehrhardt (2008, pp. 287-288) and Ross, Westerfield, and Jordan (2008, pp. 235-238) both develop similar models for dividends. The required rate of return on the stock in a company is determined by the riskiness of the company's future cash flows. The volatility of future cash flows is influenced by the industry in which the company functions, the degree of operating leverage which measures the extent to which the company uses fixed cost assets, and the degree of financial leverage which measures the extent to which the company uses fixed cost financing. The objective of this paper is to decompose the market determined beta coefficient for the company into the industry component, the operating leverage component, and the financial leverage component for a sample of companies in the soft drink industry, specifically KOPEP.

Modern Portfolio Theory originated in Markowitz (1952) which showed how to determine the optimal set of efficient portfolios available for selection by investors. The CAPM (market) beta is derived from Sharpe (1963, 1964). Sharpe (1963, 1964) develops an asset pricing model for securities based on market risk only. The market beta is the regression coefficient of the characteristic line for the stock. The characteristic line is derived from the regression between the excess return on a specific stock for a period and the excess return on the stock market index. Gardner, McGowan, and Moeller (2010) show how to compute the beta coefficient for Coca-Cola and Harper, Jordan, McGowan, and Revello (2010) show how to collect data and compute the beta coefficient for DOW Chemical Corporation. Usually, beta is computed using five years of monthly returns data or sixty observations as in SBBI (2010, p. 69).

$$R_e = R_f + \beta_A(R_m - R_f) \quad [1]$$

where,

R_e = the estimated cost of equity for the firm
R_f = the risk free rate of return
R_m = the return on the market (S&P500)
β_A = beta of the firm
(R_m-R_f) = the market risk premium

2010 Ibbotson Stocks, Bonds, Bills, and Inflation Valuation Yearbook (SBBI, 2010, p. 70, Table 6-1) reports that beta regression coefficients for excess returns are the same as beta regression coefficients for total returns using five years of monthly data. The S&P500 is used as the proxy for the stock market. SBBI (2010, p. 71, Table 6-2) reports that the correlation coefficient between the S&P 500 and the NYSE, NYSE/AMEX, and NYSE/AMEX/NASDAQ indexes are all 1.00 and that "Because of this high correlation, the ultimate market proxy chosen has only a minor impact on the beta calculation." SBBI (2010, p. 71, Table 6-3) shows that company betas for a group of ten large companies have correlation coefficients of 0.99 to 1.00. The SBBI betas are calculated using monthly excess returns for October 2004 to September 2009.

DERIVING THE BUSINESS BETA FOR A FIRM

Bottom-up betas are used to compute industry betas adjusting equity betas for both financial leverage and for operating leverage. The equity beta coefficient, $\boldsymbol{\beta_{equity}}$, for a firm is influenced by the industry, by operating leverage and by financial leverage. We adjust for financial leverage using the Hamada (1969) methodology and we adjust for operating leverage using the degree of operating leverage. The business beta is the systematic risk measure for the industry in which the firm operates.

$$\beta_{equity} = f(\text{business risk, operating risk, financial risk}) \quad [2]$$

The business beta should be similar for Coca-Cola and Pepsi because they are essentially in the same industry.

The Hamada (1969) formula for showing the impact on beta of increasing financial leverage is

$$\beta_{equity} = [1+(1-Tc)(D/E)]* \beta_{unlevered} \quad [3]$$

where,

β_{equity} = the beta coefficient adjusted for financial leverage
$\beta_{unlevered}$ = the beta coefficient with no financial leverage
Tc = the marginal tax rate
D = the market value of debt
E = the market value of equity
D/E = the debt to equity ratio

Solving for the unlevered beta for a company yields

$$\beta_{unlevered} = \beta_{equity} / [1+(1-Tc)(D/E)] \quad [4]$$

The unlevered beta can be adjusted for operating leverage using the degree of operating leverage.

$$\beta_{unlevered} = [(1+DOL)] * \beta_{business} \quad [5]$$

where,

$\beta_{unlevered}$ = the beta coefficient with no financial leverage
$\beta_{business}$ = the beta coefficient adjusted for operating leverage
DOL = the degree of operating leverage

The business beta is the unlevered beta adjusted for financial leverage divided by one plus the DOL.

$$\beta_{business} = \beta_{unlevered} / [(1+DOL)] \quad [6]$$

The business beta for a firm is adjusted for both financial leverage and operating leverage. The business beta is the beta for a company that should reflect the risk of operating in the particular industry. The market risk beta will include the effects of the industry as well as the extent that the firm uses operating leverage and financial leverage. Substituting the value of the unlevered (financial risk) beta in Equation [5] into the value of the equity beta in Equation [3] yields the three constituent components of the equity beta. The equity beta is the business beta multiplied by the adjustment factor for financial leverage times the adjustment factor for operating leverage.

$$\beta_{equity} = [1+(1-Tc)(D/E)]* [(1+DOL)] * \beta_{business} \quad [7]$$

Business beta is the equity beta divided by the financial risk factor and the operating risk factor.

$$\beta_{business} = \beta_{equity} / [1+(1-Tc)(D/E)] * [(1+DOL)] \quad [8]$$

Thus, we can determine the business risk factor by dividing the market risk beta by the financial leverage effect and by the operating leverage effect.

EMPIRICAL RESULTS

Table 1 shows the results of computing the business beta for Coca-Cola for the period from 2004 to 2012. The top panel of Table 1 contains the input data needed to compute the business beta for Coca-Cola: Total revenue, total assets, total owners' equity, total debt, operating income, and the tax rate. Panel 2 of Table 1 shows the computations needed to compute the business beta for Coca-Cola: the debt to equity ratio, one minus the tax rate, the unlevered beta divisor, the unlevered beta, the degree of operating leverage, and one plus the degree of operating leverage. The business beta for Coca-Cola is in the final row of Table 1. The average equity beta for Coca-Cola over the test period is 0.5824 and the average unlevered beta is 0.3384. The average business beta for Coca-Cola is 0.1685 and ranges from 0.0739 to 0.2344.

Table 2 provides the same computations for Pepsico for the period from 2004 to 2012. The top panel of Table 2 contains the input data needed to compute the business beta for Pepsico: Total revenue, total assets, total owners' equity, total debt, operating income, and the tax rate. Panel 2 of Table 2 shows the computations needed to compute the business beta for Pepsico: the debt to equity ratio, one minus the tax rate, the unlevered beta divisor, the unlevered beta, the degree of operating leverage, and one plus the degree of operating leverage. The business beta for Pepsico is in the final row of Table 2. The average equity beta for Pepsico over the test period is 0.5319 and the average unlevered beta is 0.2682. The average business beta for Pepsico is 0.1329 and ranges for 0.1038 to 0.1900.

Table 1

KO	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Total Revenue	21742	23104	24088	28857	31944	30900	35119	46542	48017	35067
Total Assets	31441	29427	29963	43269	40519	48671	72921	79974	86174	57356
Total Equity	15935	16355	16920	21744	20860	25346	31317	31921	33168	25897
Total Debt	15506	13072	13043	21525	19659	23325	41604	48053	53006	31459
Operating Income	5698	6085	6597	7520	8446	8231	8413	10173	10779	8594
Tax Rate	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
D/E	0.9731	0.7993	0.7709	0.9899	0.9424	0.9203	1.3285	1.5054	1.5981	1.1508
Equity Beta	0.2408	0.4952	0.4764	0.7648	0.5931	0.6108	0.5957	0.5322	0.5039	0.5824
(1-Tax Rate)	65%	65%	65%	65%	65%	65%	65%	65%	65%	0.6500
(1+(1-t)(D/E)	1.6325	1.5195	1.5011	1.6435	1.6126	1.5982	1.8635	1.9785	2.0388	1.7480
Unlevered Beta	0.1475	0.3259	0.3174	0.4654	0.3678	0.3822	0.3197	0.2690	0.2472	0.3384
DOL	0.9951	0.9617	1.0509	0.9856	0.9926	1.1120	1.0960	0.9737	0.8197	1.0043
(1+DOL)	1.9951	1.9617	2.0509	1.9856	1.9926	2.1120	2.0960	1.9737	1.8197	2.0043
Business Beta	0.0739	0.1661	0.1548	0.2344	0.1846	0.1810	0.1525	0.1363	0.1358	0.1685

Table 2

PEP	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Total Revenue	29261	32562	35137	39474	43251	43232	57838	66504	65492	50133
Total Assets	27987	31727	29930	34628	35994	39848	68153	72882	74638	50868
Total Equity	13523	14251	15368	17234	12106	17442	21476	28999	22399	19289
Total Debt	14464	17476	14562	17394	23888	22406	46677	43883	52239	31578
Operating Income	5409	5922	6506	7170	6935	8044	8332	9633	9112	7962
Tax Rate	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
D/E	1.0696	1.2263	0.9476	1.0093	1.9732	1.2846	2.1734	1.5133	2.3322	1.6048
Equity Beta	0.3549	0.3965	0.6201	0.4671	0.6131	0.5086	0.5351	0.5158	0.4632	0.5319
(1-Tax Rate)	65%	65%	65%	65%	65%	65%	65%	65%	65%	0.6500
(1+(1-t)(D/E)	1.6952	1.7971	1.6159	1.6560	2.2826	1.8350	2.4127	1.9836	2.5159	2.0431
UnleveredBbeta	0.2094	0.2206	0.3838	0.2821	0.2686	0.2772	0.2218	0.2601	0.1841	0.2682
DOL	1.0164	0.9822	1.0194	1.1328	0.8618	1.2916	0.9945	1.0411	0.7732	1.0163
(1+DOL)	2.0164	1.9822	2.0194	2.1328	1.8618	2.2916	1.9945	2.0411	1.7732	2.0163
Business Beta	0.1038	0.1113	0.1900	0.1323	0.1443	0.1209	0.1112	0.1274	0.1038	0.1329

Figure 1 shows the graphs of the business betas calculated from these empirical results. For 2005 and 2006 the betas are very similar. For the period from 2004 to 2012, Coca-Cola has a higher business beta than Pepsico. The correlation coefficient between the bottom-up betas for Coca-Cola and the bottom-up betas for Pepsi is 0.3091.

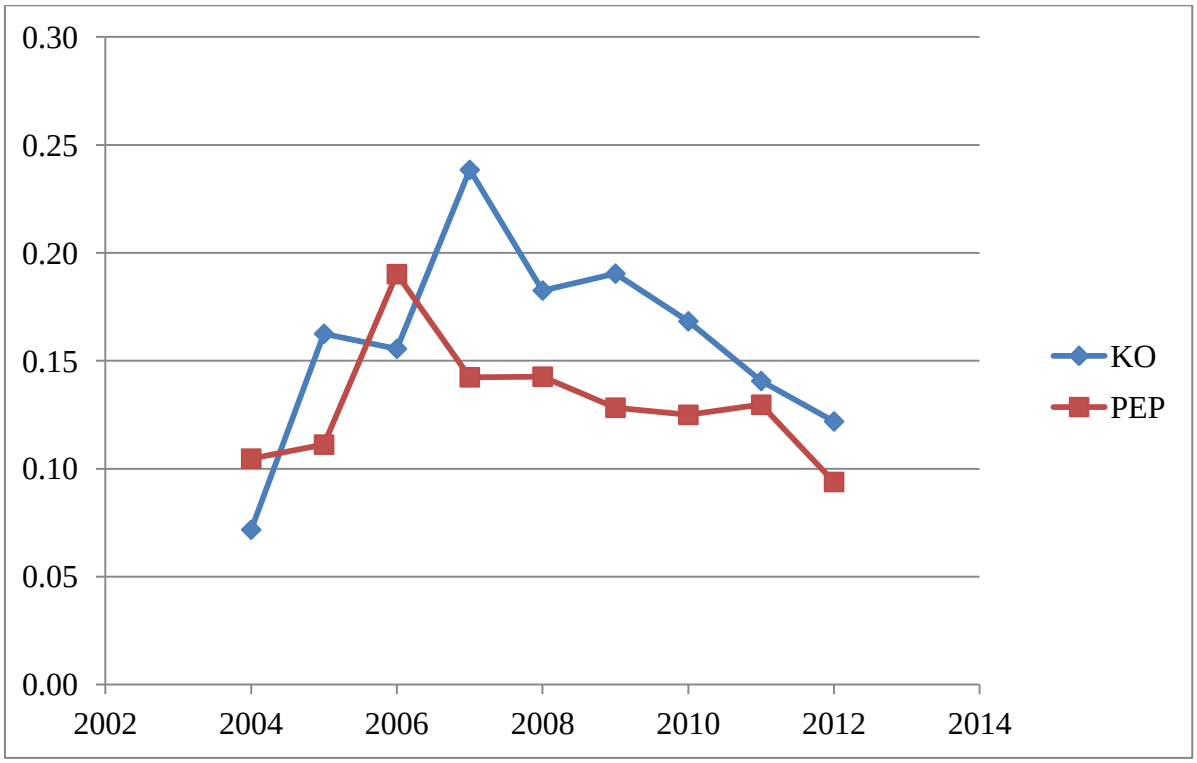

Figure 1: Business Betas for KO/PEP

SUMMARY AND CONCLUSIONS

The equity beta for a company is determined by the business risk, operating risk, and financial risk of the company. In this paper, we show how to adjust the equity beta for financial risk and operating risk to determine the business risk for the company. We apply the theory developed in this paper to Coca-Cola and Pepsico, the two largest companies in the soft drink industry, for the period from 2004-2012. The average business beta for Coca-Cola is 0.1882 and the average business beta for Pepsico is 0.1369. Over the period of this analysis, Coca-Cola has had a business beta slightly higher than the business beta for Pepsico.

DISCUSSION QUESTIONS

1. What are the determinants of corporate value?
2. What are the determinants of equity beta?
3. Which company has the higher business beta and why?

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